

$$P(t+\Delta t) = P(t) - 3 \cdot \Delta t \cdot P(t) + a \cdot \Delta t \cdot (1 - P(t))$$

$$\frac{P(t+\Delta t) - P(t)}{\Delta t} = a(1 - P(t)) - 3P(t)$$

$$\frac{\partial P}{\partial t} = a(1 - 4P(t))$$

$$\frac{\partial P}{(1 - 4P(t))} = a \cdot dt$$

↓ — integrate both sides

$$\frac{\ln(1 - 4 \cdot P(t))}{-4} = at + K \quad \text{--- constant of integration}$$

$$\ln(1 - 4 \cdot P(t)) = -4at + K$$

↓ — raise to e.

$$(1 - 4 \cdot P(t)) = Ce^{-4at}$$

$$P(t) = \frac{1 - Ce^{-4at}}{4}$$

@ $t=0$, probability of NT not changing = 1

$$\text{So, } 1 = \frac{1 - C \cdot 1}{4} \rightarrow C = -3$$

• So finally: $P(t) = \boxed{\frac{1}{4} + \frac{3}{4}e^{-4at}}$

Let $G(t)$ = Probability of NT changing.

$$\text{Then, } G(t) = 1 - P(t) = \boxed{\frac{3}{4} - \frac{3}{4}e^{-4at}}$$